compensation provides a useful limit on the bargaining freedom that helps parties reach an agreement. The FCC should specify that "mutual and reciprocal recovery" of costs means equal payment in each direction per unit of maximum capacity required to terminate traffic.

A second point of clarification needed is the meaning of "additional cost". That term should be clarified to mean the forward looking long run cost of providing the additional capacity needed for terminating interconnected traffic. The Commission should expedite the bargaining process by making the definitions precise, so that the parties (and the arbitrators) know what particular standard or range of standards they should be using. Interstate access charges (based on a FDC methodology with various mark-ups and subsidy loadings, rather than on incremental cost) cannot be a basis for interconnection under the TCA, and if CMRS is to be consistent with TCA standards, then CMRS rates cannot be based on access charges.

The forward looking costs should be used because they are the true incremental costs of adding capacity. Regardless of what was paid for current plant, the cost of adding capacity for providing terminating service is the cost of adding new plant, i.e. the forward looking cost. In general, that may be either above or below the embedded cost of plant. The capacity cost should be used as the basic standard because that is the way the costs are incurred. Assuming coincident peaks, the capacity cost approach solves the peak load pricing problem because an interconnecting carrier is effectively reserving and paying for a slice of capacity on a full time basis. So long as it is necessary for the terminating carrier to make the capacity available, it incurs the costs for termination based on expected traffic for which it prepares, not based on actual traffic. The capacity cost approach also

insulates the terminating carrier from the problem of investing in excess capacity that then is not utilized by the sending carrier.

As a bargaining framework, the Commission should specify that Bill and Keep (BAK) is the default solution until the parties reach a negotiated agreement. If traffic is balanced, reciprocal compensation will cause payments in each direction to be equal with no net payment to either party, and therefore BAK will provide the same result as any other payment level. If traffic is unbalanced, the carrier with excess inbound traffic at the peak traffic flows between the carriers should have the right to recover its incremental cost of providing terminating capacity. If the terminating costs per unit of capacity for the two carriers are not equal, the relevant costs are the costs of the carrier with excess inbound traffic. So long as the incremental capacity cost of the carrier with excess inbound traffic is used as the basis for determining net payments between the carriers, no carrier will be required to terminate traffic without compensation for its cost of carrying that traffic. Carriers will not receive their expected or desired monopoly rents, but they will receive compensation for the cost they incur in order to terminate traffic.

This approach simplifies the negotiating and data collection efforts. It is unnecessary for both carriers to submit data on incremental cost. Only the carrier that seeks net payments need submit data on incremental cost. The carrier that seeks net payments should have an obligation to present data on its own incremental capacity cost to the carrier from which it seeks net payments because of excess inbound traffic at the peak flow rate between the two carriers. That data becomes the basis for the net payments if both carriers agree, and becomes the basis for evaluation by the arbitrator or regulator if the parties fail to agree and seek outside resolution. This approach eliminates

the need to establish a general standard for incremental cost. Incremental cost is determined on a case by case basis by the parties involved or the arbitrator based on data related specifically to that case.

The approach outlined here is consistent with both the CMRS NPRM and with the TCA, and it answers many of the criticisms raised in LEC comments regarding the NPRM proposals. Consistent with the NPRM, this approach uses BAK as an interim measure. However, contrary to LEC fears that the interim measure will become permanent and prevent any incentive for favored companies to bargain, the procedures proposed in the TCA allow bargaining away from the initial point. Using BAK as the default arrangement until agreement is reached is more incentive compatible than using the current arrangements as the default until agreement is reached because it provides incentives for the LECs to develop their incremental cost data and other information needed to support a negotiated interconnection agreement. Generally, the incumbent LECs are opposed to BAK and the potential entrants (both wireless and wireline) are satisfied with BAK. The success of negotiations depends on good faith efforts on both sides to clarify the relevant costs and traffic patterns. The LECs are generally the ones claiming the right to net payments to them from the parties that interconnect with them. If the interim solution is more favorable to the LECs than the expected negotiated solution, then they will have an incentive to delay the development of data supporting their incremental cost claims. However, if the interim solution is less favorable to the LECs than the expected negotiated solution, they will have an incentive to speed the negotiation process. Therefore, the specification of BAK as an initial solution pending completion of negotiations provides the incentives for the party with possession of the cost data to produce it quickly and bring the

negotiations to a conclusion. If the traffic flow between the parties approaches balance, that negotiated solution may be a continuation of the interim BAK solution because net payments between the parties will disappear when the traffic is balanced.

III. Economic Efficiency of Current Arrangements Versus BAK

Several parties have asserted that the Commission's BAK proposals would be economically inefficient because they do not require an exact match of prices with cost. They then conclude that the current system is working adequately and should not be changed. They are correct that the theoretically correct pricing structure is for prices to equal long run incremental cost. However, many of the same parties that challenge BAK because it does not equal incremental cost also support the continuation of current arrangements which are much further from incremental cost. They seem unconcerned about the efficiency losses from pricing interconnection far above incremental cost but very concerned about the efficiency losses from pricing interconnection slightly below incremental cost.

The existing arrangements for LEC to CMRS interconnection provide for one-way payments far in excess of incremental cost. Such payments create inefficiency in the overall market as Jerry Hausman has explained:

> To promote economic efficiency, network interconnection rates should be set at long-run incremental (marginal) costs, because interconnection is an intermediate good....
>
> Currently, Cellular One pays NYNEX an interconnection charge when sending traffic to NYNEX. However, NYNEX does not pay a similar interconnection charge to Cellular One when NYNEX delivers a call to the Cellular One system. This lack of reciprocal pricing leads to economic inefficiency and reduced competition....
>
> The Department should indicate its support for the principles of reciprocal compensation and interconnection based on incremental costs. It should

> encourage carriers to negotiate mutually agreeable arrangements for network interconnection and compensation. Negotiated agreements are likely to encourage an economically efficient and technically flexible solution, which will benefit the customers of each carrier. If the companies involved are unable to come to an agreement, the Department should arbitrate the differences that may exist and determine reasonable terms and compensation for interconnection.
> (Testimony of Jerry Hausman in Massachusetts DPU case 94-185, pp. 5-7, attached to the comments of SBC Communications in this proceeding.)

Although Hausman contradicts his Massachusetts testimony with his statement on behalf of Pacific Bell in this proceeding ("it would be inappropriate regulatory policy and incorrect economics to apply interconnection set at long run incremental cost" Hausman statement attached to Pactel comments, p. 5), his Massachusetts testimony provides an explanation of the inefficiency of current arrangements and a good outline of an economically efficient long run solution to CMRS interconnection:

(1) Reciprocal compensation;

(2) Interconnection rates at long-run incremental cost;

(3) Details of interconnection agreements set by negotiation among carriers with provision for binding arbitration.

I largely agree with the Hausman Massachusetts principles as a long run solution, but think that he underestimates the problems of negotiating incentives and of transactions costs. The missing critical element is an appropriate short run solution that is a reasonable approximation to the long run solution and provides good bargaining incentives. If the short run solution is the status quo, then the LECs have an incentive to delay the bargaining as long as possible, continuing the current inefficient regime that provides benefits to them. A short run prescription of Bill and Keep, on the other hand, will be closer to the economically efficient solution than the status quo, and will provide

incentives for the LECs to produce evidence for the incremental costs they incur in providing capacity to terminate CMRS traffic in order to justify moving away from BAK. Furthermore, Hausman's analysis largely ignores the transactions costs involved in measuring and billing for terminating traffic. Even without exactly balanced traffic, carriers who are required to pay reciprocal compensation may decide that it is in their best interests to adopt bill and keep voluntarily rather than incurring the transactions costs of measuring and billing for a small net payment. However, I believe that long run interconnection on a BAK basis should be a voluntary decision of the carriers involved rather than a regulatory requirement.

IV. The Internet Precedent

In previous papers submitted to the Commission, I noted that Internet Service Providers who are members of the Commercial Internet Exchange (CIX) exchange traffic on a bill and keep basis without settlements payments. Because the Internet is the only large scale public unregulated network of networks, I consider the arrangements negotiated by Internet providers to be significant evidence regarding the kinds of interconnection arrangements that would be reached by network providers without regulation or dominant firms. Several parties have challenged the factual accuracy or the policy relevance of the Internet precedent for interconnection on a BAK basis. U S West provided an extensive history and commentary on Internet interconnection issues as a response to my comments on Internet interconnection (U S West, Attachment B).

The U S West paper makes three primary points:

(1) Not all Internet providers receive settlement-free interconnection;

(2) The current settlement-free interconnection policies on the Internet may not survive in the future;

(3) The Internet is different from the telephone network and interconnection procedures developed for Internet may not be applicable to the telephone network.

Neither U S West nor any other commenter in the proceeding has challenged the basic factual point in the Internet example: a large number of unregulated competitive network providers voluntarily exchange traffic without payments among the parties for terminating traffic. In the proposed BAK interconnection arrangements for CMRS carriers, it is necessary to make a clear distinction between customers and carriers. Carriers are entitled to favorable interconnection with each other because interconnection benefits all carriers and their customers. Customers pay their carrier for services provided. Under the TCA, a clear distinction between customers and carriers will be necessary to clarify which parties are entitled to the privileges of telecommunication carrier status and which parties are required to bear the burdens of telecommunication carrier status (such as potential assessment for universal service support). The Internet does not have a legal distinction between customers and carriers. However, it has that functional distinction in the varying interconnection arrangements voluntarily reached by the parties involved. Providers that resemble a telecommunication carrier are more likely to achieve interconnection arrangements on a BAK basis than providers that resemble a telecommunication customer.

Many of the objections to the Internet example consist of assertions that the current system of settlement free interconnection either cannot or should not survive.

They include predictions that the current system will collapse as the Internet expands and becomes more congested. They also include conclusions that the current settlement free interconnection arrangements should not survive because it is inefficient. The current system may not survive, but it has shown great resiliency during a time of extraordinary growth and change in the Internet. If the BAK system were as unstable as its critics suggest, it should have collapsed already because of the rapid increases in number of providers and total traffic carried over the Internet. The assertion that the current system should not survive because it is inefficient contradicts the normal presumption that competitive voluntary arrangements reach maximum efficiency. A number of sophisticated mathematical models of optimal pricing for the Internet have been developed with proposals for complex pricing plans and settlements arrangements.[1] However, those models fail to take account of the extensive transactions costs that would be required to implement complex plans. Because the current arrangements are the result of competitive processes, it is likely that they are efficient when all relevant costs are taken into account.

The third point made by the critics is that even if current Internet providers interconnect on a BAK basis, and even if the current arrangements survive, that the Internet example is irrelevant to CMRS-LEC interconnection because the Internet is very different from telephone interconnection. They note that the Internet uses packet switching while the telephone network uses circuit switching and that the Internet is unregulated while the telephone network is regulated. The distinctions drawn between the

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[1] See, for example, Q. Wang, M. Sirbu, and J. Peha, "Pricing of ATM Network Services," W. Lehr and M. Weiss, "The Political Economy of Congestion Charges and Settlements in Packet Networks," and S. Shenker, D. Clark, D. Estrin, and S. Herzog, "Pricing in Computer Networks: Reshaping the Research Agenda," all in Gerald Brock and Greg Rosston, eds. The Internet and Telecommunications

Internet and the telephone network do not reduce the significance of the example. The point is to figure out what would happen in a competitive unregulated network of networks. We already know what happens in a regulated network dominated by firms with monopoly power. If the Internet were precisely identical to the current regulated telephone industry, it would provide no new information about the likely shape of a future telephone network with greatly increased competition and little or no regulation. It is precisely the differences between the Internet and the current regulated telephone network that make the example relevant.

V. The Potential for IXC Arbitrage

One objection raised to the Commission's proposal for CMRS interconnection is that it would create opportunities for arbitrage against high interstate access charges. If CMRS providers interconnect on a favorable BAK basis and IXCs are required to pay interstate access charges, there is an incentive for the IXC's to "launder" their terminating traffic through a CMRS provider. That is, IXC traffic designated for a LEC destination could be first routed through a CMRS provider and then from the CMRS provider to the LEC. In that scenario, the function played by the CMRS provider is to disguise the identity of the IXC minute (subject to access charges) and make it appear to be a minute originated by a CMRS carrier (entitled to BAK or incremental cost interconnection).

The arbitrage problem is neither new nor unique to CMRS interconnection. Potential arbitrage between high interstate access rates and low rates for equivalent service not classified as interstate access has been dealt with by the Commission many

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Policy: Selected Papers from the 1995 Telecommunications Policy Research Conference (Mahwah, New

times in the two decades since the issue was first raised by MCI's Execunet service. There are presently a wide variety of rates for interconnection: interstate access, intrastate access, LEC-LEC interconnection, CAP-LEC interconnection, and CMRS-LEC interconnection. The different rates for physically similar services create opportunities for arbitrage. The Commission has limited arbitrage opportunities with a series of imperfect expedients such as the "Percentage of Interstate Use" (PIU) factor used to distinguish traffic charged at interstate access rates from traffic charged at intrastate access rates.

The long run solution is to move toward a more unified approach and that should be done in the context of TCA implementation and access charge reform. However, there is no possibility of eliminating the opportunities for arbitrage simply by setting a CMRS rate at any particular level. If the rate is set at the level of interstate access charges, for example, opportunities for arbitrage with interstate access traffic are eliminated, but opportunities are created for arbitrage with any other service charged at a different interconnection rate.

A simple short run solution to the potential arbitrage between CMRS-LEC interconnection rates and IXC-LEC interconnection (access) rates is to impose access rates on any traffic delivered to a LEC for termination after being received from an IXC. That is, pure transit traffic across a CMRS network (neither originated nor terminated by the CMRS carrier) would not be entitled to the Bill and Keep interconnection if it would have been subject to interstate access charges without the CMRS intermediary. The CMRS carriers could be required to report such traffic and pay access charges.

Jersey: Lawrence Erlbaum Associates, 1996, in press).

VI. Conclusion

The current system of one way payments far above incremental cost from CMRS carriers to LECs is inefficient and will become an increasing problem as the PCS systems are developed. As PCS systems are implemented, CMRS prices are likely to decline and therefore high non-symmetric interconnection charges will be a greater detriment to the efficient operation of CMRS providers in the future than at present. It is hard to see how CMRS providers could ever provide effective competition to LECs if the current level of interconnection charges is continued because the interconnection charges alone could be more than the LEC would charge for landline service.

While there are many variations in the details of proposals presented by various parties, there are only two fundamental models of interconnection at issue in this proceeding:

(1) The Commission's NPRM, and most parties other than the LECs, support a model in which all carriers are treated symmetrically as co-carriers. Interconnection is a benefit to both parties. Payments for interconnection (if any) are symmetrical. There is a clear distinction between carriers entitled to symmetrical payments for traffic interchanged for mutual benefit and customers who pay for service received. At maximum, interconnection payments are determined by the incremental cost of providing the interconnection service. Common costs and social obligation costs are built into the prices charged final customers, not into interconnection rates. Within the supporters of this model, there are differences of opinion as to whether actual payments based on the incremental costs of interconnection should be made or whether the net payments would be so small in relationship to transactions costs that

bill and keep would be more efficient than attempting to measure and charge for net traffic flows among carriers.

(2) The LECs generally support an interconnection model in which interconnecting carriers (including CMRS carriers) are treated as customers of the LEC. Those desiring interconnection with the LEC should pay for the privilege just as any other customer that desires service should do. There is no reason for the LEC to pay the interconnecting carrier for traffic delivered to it because that is simply customer inbound traffic. Consequently, interconnection payments would be non-symmetric and there would be a net payment from the connecting carrier to the LEC even if traffic were exactly balanced or if the connecting carrier had excess inbound traffic from the LEC. Interconnection charges are analogous to the charges for any other customer and should include the incremental cost as a minimum, but should also include mark-ups for common costs and social obligations. The degree of mark-up over interconnection charges would be determined by the elasticity of demand and other market forces computed in the same way as any other price to a final user would be computed.

The co-carrier model is the most efficient one for developing the future competitive unregulated network of networks. The co-carrier model is also the only one consistent with the Commission's NPRM in this proceeding and with the Telecommunications Act of 1996.

This proceeding can and should be completed expeditiously in a way that promotes efficiency and advances the Commission's efforts to implement the provisions of the TCA. The Commission ought to adopt bill and keep as the interim interconnection arrangement

between CMRS providers and LECs, with the interim period to end when agreements are reached through negotiation and, if necessary, arbitration. The Commission should adopt the following principles to guide the negotiations for interconnection arrangements:

(1) Mutual and symmetric payments for traffic based on peak traffic capacity required to terminate traffic from the parties;

(2) Net payments for interconnection determined by the long run forward looking incremental capacity cost of the carrier with excess inbound traffic;

(3) Interconnection terms and conditions determined by negotiation among carriers, subject to the principles specified by the Commission, with opportunity for binding arbitration in case of failure to reach agreement.